Introduction

Idukki, a richly forested district of Kerala, is home to nine major tribes. The living and evolving knowledge base of the forest dwelling tribal communities and their traditional practices have formed the basis of this study. The treasure trove of traditional knowledge and the spirit of empathy which the tribal communities harbour towards nature offer valuable models of man-environment relationship. The forest dwelling tribes of Idukki are in close proximity with the natural world and their activities are not necessarily harmful to the environment. These communities have lived in the forest for centuries with least damage to their habitat.

The tribal communities have distinct culture, language, traditions and modes of living. The developed communities of the present day harbour deep concerns for sustainability of the environment which is directly linked to their happiness as well as their socioeconomic development. With expanding populations and shrinking natural resources, the most important challenge facing developing societies is sustainable development through environmentally healthy practices. There can be no common future for humankind without a better common present. Development which is not equitable is not sustainable in the long term. This is the message of both past and recent history. A sense of harmony within nature which was central to the ethos of pre-industrial societies as well as a spirit of goodwill among all members of human family are both fast vanishing today (Swaminathan, 1990). Ensuring technology advancement and safeguarding the environment have now become two of the most important responsibilities of modern societies. Consequently there is a growing interest and concern about the need to respect the sustainable traditions of rural and tribal communities who have lived in a spirit of sharing and caring for nature.

This study focuses on the tribes of Idukki with special attention to the Muthuva communities dwelling in interior forests. The emphasis of the study has been on the impact of their life style on environment and the role of forest ecosystems in shaping their life and culture. Idukki district, the study area is located in the southern portion of the Western Ghats. The district has a total area of 4476km^2 and covers 11.5% of the total area of Kerala state. Ten major dams have been constructed in this area and there has been a consequent displacement of tribal people from their natural environment. The population of the district is 1,107,453 out of which 4% are tribals who number 50,000

(Census report 2011). The tribes in the district live in 277 settlements, of which 181 are either inside dense jungles or on the periphery. 91 settlements are outside forests and 5 are in isolated locations away from forests.

The study focused only on the tribal communities that live close to natural environments and isolated from strong non-tribal influences. It has excluded the tribals who live away from natural environments and have easy access to modern amenities such as transport, communication, education and health care.

Objectives of the study

The main objective of the present study is to analyze the environmental sustainability of tribal life pattern. The following aspects of tribal life have been investigated.

1. Dependence of tribals on forest for food, medicine, fuel, housing and livelihood.
2. Customs, traditions, dress, religious beliefs, dialect and education of tribes
3. Possibilities for joint forest management and ethinic tourism in tribal areas
4. Applications of mathematical tools for the analysis of the present tribal situation.

The study tries to draw out possible lessons from the tribals for more sustainable life which modern societies can emulate in order to lead a meaningful life based on the man-nature relationship. In this work three mathematical tools for modelling using fuzzy theory have been modified to analyse the tribal situation.

Methodology

The study was carried out through field visits for participatory observation and for gathering first hand information from persons such as tribal volunteers, teachers of multilevel learning centers who live in the hamlets, the officials of tribal departments, representatives of the Grama Panchayats and traditional healers of the tribal areas. The study involved the generation of primary data through surveys as well as collection of secondary data. The tribals in their hamlets were drawn into discussion on specific issues. Listening to oral histories, participating in various functions of religious and cultural importance, and participation in the day to day activities in the tribal hamlets have provided useful information. It was possible to study the impact of tribal community life on the ecosystem through an evaluation of people's perceptions on ecological processes. Moving along with the tribes while they were on collection of various forest produces provided inputs on their involvement with the natural

surroundings and their dependence on the forest ecosystem. Identification of the major landscape elements and the preparation of a basic inventory of flora and fauna of the tribal areas were made on such visits. Staying with the tribes in their hamlets have provided information regarding their day to day activities, their approach to life and their perceptions of nature, God and the outside world. Such exercises have also brought to light the impact of nature on their values and customs and vice versa. Available remote sensing data have been used to illustrate the geophysical conditions of the study area. Analysis of the psycho- philosophical studies that have been made in the past were done. The social theory that links the environment and the tribal communities has also been looked into.

The principles of fuzzy theory applied to analyse tribal situations have proved the strength of using such techniques to evaluate tribal welfare. Fuzzy theory has been found useful in modeling various decision making problems involving fuzziness. Hence the theory has been applied effectively for analysis of unsupervised data. It is possible to obtain the hidden pattern of a dynamical system by applying fuzzy theory. Since issues related to tribals involve uncertainities and unpredictabilities, it would be appropriate to make use of fuzzy theory for such analysis. Three different models of applying fuzzy theory have been explored in this study. In the first method, fuzzy poverty index, fuzzy welfare function and fuzzy welfare index are used for comparing welfare of tribals living in two separate colonies; one located in the interior forest and the other away from forest and having contact with non-tribal communities. In the second method, fuzzy cognitive maps (FCMS) have been used to analyse the relationship between conservation of environment and empowerment of tribals. In the third method Fuzzy Relational Maps (FRMs) are used to analyse the role of forest dwelling tribes in biodiversity management. These methods have thus been shown to be useful in the analysis of the probable impacts of tribal welfare activities even before they are implemented.

Statement of the Problem

The tribes who habituate the dense jungles of the Western Ghat area of Idukki district have from time immemorial lived a life of harmony with nature. In the past they never had any concern about the ownership of the land they lived on but always depended on the forest for livelihood. In recent times, large scale deforestation for hydroelectric

projects and for raising plantations as well as encroachments have drastically drained their resource base and this has critically strained their relationship with nature. The efforts of the government for the development and empowerment of tribal communities have not brought about the expected results. Yet in the dense jungles of the district, different clans of tribes, live as communities well insulated from the modernized societies by integrating their lives with the ecological cycle of the forests. They never inflicted any major harm on the ecology of the forests in which they live. But the forest regulations and restrictions imposed from time to time have shown scant sensitivity to their aspirations. These tribes have over the past centuries, imbibed a sense of harmony with nature. Their life styles comprising food habits, mode of collecting minor forest produces, festivals, rituals and ceremonies as well as their outlook on life are naturally tuned to the requirements of sustainability of the forest ecosystem. The modern civilized communities have much to learn from the simple lives of the tribes in order to live a life of harmony with nature. As modern societies grasp the necessity for protection of the environment side by side with progress in technology, there is lack of information regarding healthy man-environment interaction. The tribes who lived in the forests, which are rich in biological diversity, are very poor. But the masters of technology, who are rich, live in areas which are very poor in biological diversity. However, for a better future for the humankind, biological diversity should be conserved. The genius developed in tribal communities through centuries of harmonious life would certainly enlighten modern man who has of late begun to search for alternate life styles which would make the earth a better place for future generations.

Findings

The study has revealed the intimate relationship that the forest dwelling tribal communities of Idukki district maintain with their natural environment. Their dependence on forest for the sustenance and livelihood have been analysed. The shrinking of forest space available to the tribals have affected their welfare on account of the reduced availability of the biodiversity resources of the forests. This has simplified the diversity in food intake, reduced income from collection of minor forest produces and has affected their traditional diet. The trapping and hunting of animals for minor game has almost been abandoned in most of the tribal settlements on account of the severe forest restrictions. Hence tribals are forced to seek outside employment to earn their livelihood and to pay for purchasing food from the market. The changes in

dress and wearing of ornaments have drawn the tribals into the consumerist culture of the mainstream communities. The presence of television and other communication facilities in the tribal hamlets have aroused in them an enthusiasm to adapt to the modern ways of living. The education provided to the tribals is meager in most of the settlements. The children are weak in learning on account of their inability to adapt to the alien system of education, which does not take into account the tribal aspirations. The tribal children who are made to attend the regular schools are removed from the traditional tribal education provided by the elders in their hamlets and at the same time they are not able to benefit from modern education.

For several centuries, the tribals have been leading a peaceful life in isolated groups within the jungle. Each tribe had developed its own social system for healthy community life. But by the middle of the 20^{th} century people from outside the tribal hamlets began to influence them through unsolicited contacts. Though these people looked upon the tribals as uncivilized and uncultured, the seamless greed and the unending needs of these people depleted the tribal ecosystem of valuable resources. The health and the economy of the tribals were deeply affected on account of such disturbances to their natural environment. The significance of natural environment and forest ecosystem in the sustenance of the tribal people was not a matter of concern either for the intruding modern man or for the regulating government machinery. For the tribals on the other hand, the bare necessities of life sufficed and they are much content with the dwindling resources available in the forests. But now these people are being severely exposed to the pressures of modern wants and they are gradually becoming a prey to the all consuming consumerist tendencies which is characteristic of modern culture.

It may be noted that the tribal communities still live on very small ecological foot prints and have, a life style that makes their lives highly contented and at the same time sustainable. The attempt in this work has been to approach development of environmentalism and compare it with the aspirations of ‘Modern’ societies and to relate the study to real life of the underdeveloped tribals.

Although the women shun outsiders and there is an apparent male domination in the Muthuva community, it was found that the women have a clear say in the day to day affairs of the hamlet and in matters of public interest. The women have a place of

prominence in the family and they are given special protection and care by all men within the hamlet. They are aware of their roles and play an important part in agricultural activities of the *Kudy* (hamlet) as well as in all festivals and rituals.

Socio-philosophical analysis revealed a convergence of environmental conservation and tribal welfare. The intimate interactions with the tribal communities exposed their deep concerns for the sustainability of the environment and awareness of the consequences such as erratic rainfall that can result from wanton destruction of the forest ecosystem. The study also showed that they have an instinct for resource conservation.

It was revealed that there is real threat of language endangerment and consequent extinction of cultural aspects and traditional knowledge as the younger generations are weaned away from traditional elements of culture, education, health care and sustenance. The younger generations were found to have adoration for the modern amenities and life styles, but the older generation holds a fear for the negative impacts that would affect the continuity of their traditions, culture and identity.

The observations on the traditional methods of tribal house building using locally available materials revealed the relevance of the sustainable housing system prevailing and the role of the elders, women and children in house building activity. The food habits of tribals were found healthy and their dependence on grains from outside could be eliminated if they were provided land in accordance with provisions of the Forest rights Act 2006. The extension of mathematical modeling using Fuzzy theory has shown that fuzzy theory can be successfully used for the analysis of the tribal status.

The study has analyzed major transformations in tribal communities and the kinship they maintain with nature. The essential environmental prudence which need to be maintained by the modern communities in their efforts for development and modernization can be fashioned in accordance with the proven attitudes and approaches to environment maintained by these tribal societies. The overall argument of the present investigation is that environmental sustainability and tribal welfare in the forest can be achieved simultaneously by devising approaches which would be in tune with tribal aspirations.

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